

What is Claimed:

- 1 1. An apparatus for analyzing an impurity in a liquid for use
2 with a light source, comprising:
3 a cell coupled to the light source comprised of:
4 a first mirror at a first end of the cell to receive a light
5 from the light source and pass the light into the cell along
6 a longitudinal axis of the cell, and
7 a second mirror at a second end of the cell to at least
8 partially reflect the light from the first mirror back along
9 the longitudinal axis to the first mirror;
10 a first liquid supply device adapted to project a first stream of
11 the liquid between the first mirror and the second mirror and across the
12 longitudinal axis of the cell; and
13 a detector coupled to the second end of the cell and adapted to
14 determine a decay rate of the light within the cell based on the light passing
15 through the liquid.
- 16 2. The apparatus of claim 1, further comprising a polarizer
17 coupled between the light source and the cell.
- 1 3. The apparatus of claim 1, wherein the liquid stream is
2 projected freely into the cell.
- 1 4. The apparatus of claim 1, wherein the cell is substantially
2 open.

1 5. The apparatus of claim 1, wherein the liquid stream
2 intersects the longitudinal axis of the cell at a predetermined angle so as to
3 substantially reduce reflection of the light by the liquid stream.

1 6. The apparatus of claim 5, wherein the angle of
2 intersection is complementary to Brewster's angle.

1 7. The apparatus of claim 1, further comprising a processor
2 coupled to the detector to determine a level of the impurity in the liquid
3 based on a decay rate of the light within the cell.

1 8. The apparatus of claim 7, wherein the processor is
2 adapted to determine the level of the impurity in the liquid based on a
3 difference between a first ring-down rate measured at an off-peak
4 wavelength of a profile of the impurity and second ring-down rate measured
5 at a peak wavelength of the profile of the impurity.

1 9. The apparatus of claim 7, wherein the processor is
2 adapted to determine the level of the impurity in the liquid based on a whole
3 peak profile measurement.

1 10. The apparatus of claim 1, further comprising:
2
3 an optical splitter coupled to the light source to split the light
4 from the light source into a first beam and a second beam, the cell coupled to
5 the optical splitter

6 a second cell coupled to the optical splitter, the second cell
7 comprising:

8 a first mirror at a first end of the second cell to receive the
9 second beam and pass the second light beam into the second
cell along a longitudinal axis of the second cell, and

10 a second mirror at a second end of the second cell to at least
11 partially reflect the light from second beam back along the
12 longitudinal axis to the first mirror;

13 a second liquid supply device adapted to project a second
14 stream of a second liquid substantially free of the impurity into the second
15 cell between the first mirror and the second mirror and across the
16 longitudinal axis of the second cell; and

17 a second detector coupled to the second end of the second cell
18 and adapted to determine a decay rate of the second light within the second
19 cell.

1 11. The apparatus of claim 10, further comprising a processor
2 coupled to the first detector and the second detector, wherein the processor
3 is adapted to determine the level of impurity in the liquid based on a
4 difference between the decay rate in the cell and the second decay rate in
5 the second cell.

6 12. A method for analyzing a trace species in a liquid for use
7 with a light source, comprising the steps of:

8 emitting a light from the light source;

9 passing the light through a first stream of the liquid;

10 measuring a decay rate of the light passing through the liquid;

11 and

12 determining a level of the trace species based on the decay rate.

1 13. The method of claim 12, further comprising the step of
2 polarizing the light after the emitting step.

- 1 14. The method of claim 12 further comprises the steps of:
2 splitting the light from the light source into a first beam and a
3 second beam;
4 passing the first beam through the first stream of liquid
5 containing the trace species;
6 passing the second beam through a second stream of liquid
7 substantially free of the trace species;
8 measuring a first decay rate of the first beam passing through
9 the first stream of liquid;
10 measuring a second decay rate of the second beam passing
11 through the second stream of liquid; and
12 determining the level of the trace species in the first stream of
13 liquid based on a difference between the first decay rate and the second
14 decay rate.
- 1 15. The method of claim 12, wherein determining an
2 absorption spectrum of the trace species in the liquid is based on a difference
3 between a first ring-down rate measured at an off-peak wavelength of a
4 profile of the trace species and a second ring-down rate at a peak wavelength
5 of the profile of the trace species.
- 1 16. The method of claim 12, wherein the determining step is
2 based on a first whole peak profile measurement.
- 1 17. The method of claim 12, further comprising the step of
2 projecting the first stream of liquid across the light at a predetermined angle.

1 18. The method of claim 17, wherein the predetermined angle
2 is selected to reduce an external reflection of the light.

1 19. The method of claim 18, wherein the predetermined angle
2 is about complementary to Brewster's angle.

1 20. An apparatus for analyzing a trace species in a liquid,
2 comprising:

3 means for emitting a light;

4 means for passing the light through a first stream of liquid;

5 means for measuring a decay rate of the light passing through
6 the first stream of liquid; and

7 means for determining a level of the trace species based on the
8 decay rate.